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Dear Burr:

Esther and I have just returned from a month's trip in Europe and I was just delighted to see your letter of June 8th on top of the pile of mail. I could only wish that the Academy had responded in this way as far back as December 1957 when I first began pestering Bronk myself about it.

Much more than agree, I would insist that a committee with the broad, basic orientation that you outline is absolutely indispensable. I share your views that the committee on bio-astronautics would not be the ideal agency for this type of work. It is, first of all, primarily committed to support of a program, manned space flight, whose basic merits and feasibility seem very questionable either as science or military defense. Its military connections and obligations are bound to dilute consideration of basic problems at the most advanced theoretical level. These same associations, further, would also hinder free communication with scientists in other countries, whose interest and cooperation we should, of course, actively seek. On the other hand, bio-astronautics should have ready access to the conclusions of our "exobiologists." So both for liaison and because of the merit of his own work and interest, I would suggest that Calvin should be represented on such a group.

The reservation that I do have with respect to possible duplication concerns the Space Science Board of the National Academy. Its "Biology and Psychology Subcommittee" is headed by H. K. Hartline. The title of this subcommittee is perhaps not too promising but Hartline has just written me that he and his associates are really much more interested in "basic scientific problems of space biology" than in matters connected, for example, with man in space. He also, in a very gratifying way, expressed the extent to which his colleagues on the Board share my own concern for avoiding inadvertent contamination as the first step in a sober program.

However, I am sure that Hartline himself would say that the backgrounds and interests of his subcommittee are not sharply focused on the problems of extraterrestrial life.

There have been two informal groups, in doggerel Eastex and Westex, which have been studying and discussing exobiology during the past several months. We have had no formal status except as self-constituted discussions whose conclusions have, nevertheless, been forwarded to the Space Science Board through Bruno Rossi. Hartline has since asked me to join his subcommittee to serve the same function of liaison. I am enclosing some of the papers that have come out of the Eastex and Westex meetings. The Space Science Board has undertaken to pay the travel expenses of the meetings to date and those that may be held in the near future. As you will see from the enclosures, our first discussions placed considerable stress on the problem of contamination in view of the meetings of Cetex and Cospar in April. Since then we have also gone into more positive programs, not neglecting the philosophical issues too. We have been advising the Jet Propulsion Laboratories on desirable protocols for attempts at infrared scanning of Mars for the verification of C-H, N-H and C=O groups in organic molecules. These experiments will presumably be included in the Atlas Vega program in 1960-61.

So we may have a small dilemma. We certainly need a competent body uncommitted to particular applications, to review the problems of exobiology. These may be included among the most important issues of the generation and perhaps not only in a scientific context. On the other hand, the effector is NASA which should get its advice from the existent Space Science Board. Whether NASA will continue to listen very intently to the Board has been questioned in several quarters but certainly some such channel is vitally needed. Still we don't want to waste a lot of time and energy by duplicate and overlapping work by disconnected groups.

I wonder if the happy solution to this, that would preserve all of the advantages, might not be to incorporate the existing Eastex and Westex groups as regional sections of the new committee you have in mind. The regional set up has worked out, I think, as a rather satisfactory experiment since we can much more conveniently get together and the group includes people who have continued personal contacts in any case. You might find it advantageous to get together a third Midwestern group which should include such talent as Kulper and Kim Atwood. I would suggest that you consult Luria at M. I. T. to find out the hard core of the Boston section. At this end, I would hope that this could include: Calvin, Stent, Weaver, Stanier, Novick, Marr, Urey, Horowitz, Nelson and van Niel. Urey has been pretty busy and has other connections through NAS but he is so knowledgeable on the

geochemical aspects of exobiology that we can hardly afford not to get the most out of him. We have not found a group of this size to be unwieldy at all and have usually profited from additional guests at each meeting. There is such a tremendous range of scientific disciplines to assimilate!

Is there any point to giving some formal status to an already existing group? This would certainly be preferable to trying to reorganize still another committee, and I suspect you would end up with a composition that was not greatly different from this one. There might be some element of prestige, both to add some possible weight to representations to the Space Board and to NASA and to help fix a sense of responsibility on the part of the group. For example, a valuable member like Roger Stanier might be encouraged to continue after all if he could assure himself that he was doing more than indulging a private whim. In addition, some of us have not let our enthusiasm for scientific exobiology completely overwhelm our personal exasperation over some of the monkey-business that can be perpetrated in the name of science. Should this become an occasion for public criticism by individual participants, it might be more congenial if the committee had some backing independent of the space program as such. I would urge you to discuss with Hartline how an independent committee might relate to the Space Science Board which would include such questions as the financing of the meetings. While the regional conferences are best for the preparatory stages, I should think that in due time it would be advantageous to hold a national or even better, international meeting. In fact, one of the most constructive tangible things that the Academy could do at the present time, would be to try to organize an international conference on extra-terrestrial life to be cosponsored, preferably, by the U. S. and the USSR Academies of Sciences. Political channels on matters connected with the space program have, as you know, been noisy and uncertain. I would consider it a matter of highest importance to make relevant contact with our scientific opposite numbers in the USSR in time for them to have some voice in the Russian space program and perhaps to avoid an irremediable error.

We have talked, to some extent, about all of the issues that you raise in your memorandum but have, of course, not nearly exhausted them. I should be much less concerned about noncarbonaceous systems of life than I might have been a couple of years ago. The main point is that there is plenty of carbon everywhere and carbon still does remain the most prolific chain-building unit. In hotter environments, however, polyphosphates and polysiloxanes might play a distinct role. One of the things to look for in the lunar crevices should certainly be some solvent silicones which are perhaps not altogether improbable products of reaction between organic free radicals and  $\text{SiO}_2$ . There is an even more amusing

situation on Jupiter. Miller-type processes in the Jovian atmosphere should lead to the deposition of immense quantities of amino acids and their sedimentation to the bed of the ammonia-methane oceans. It will be a long time yet before we can think of a direct exploration of that habitat! But Carl Sagan is interested in setting up some laboratory models.

I'm sorry that I can see no likelihood of visiting you at Woods Hole but would be happy to continue this correspondence. Perhaps you might like to think of coming to our next Westex meeting which should be held probably late in September to review a draft "position paper" for the Space Science Board.

Yours as ever,

Joshua Lederberg  
Professor of Genetics